SPECS
Climate Prediction for Climate Services

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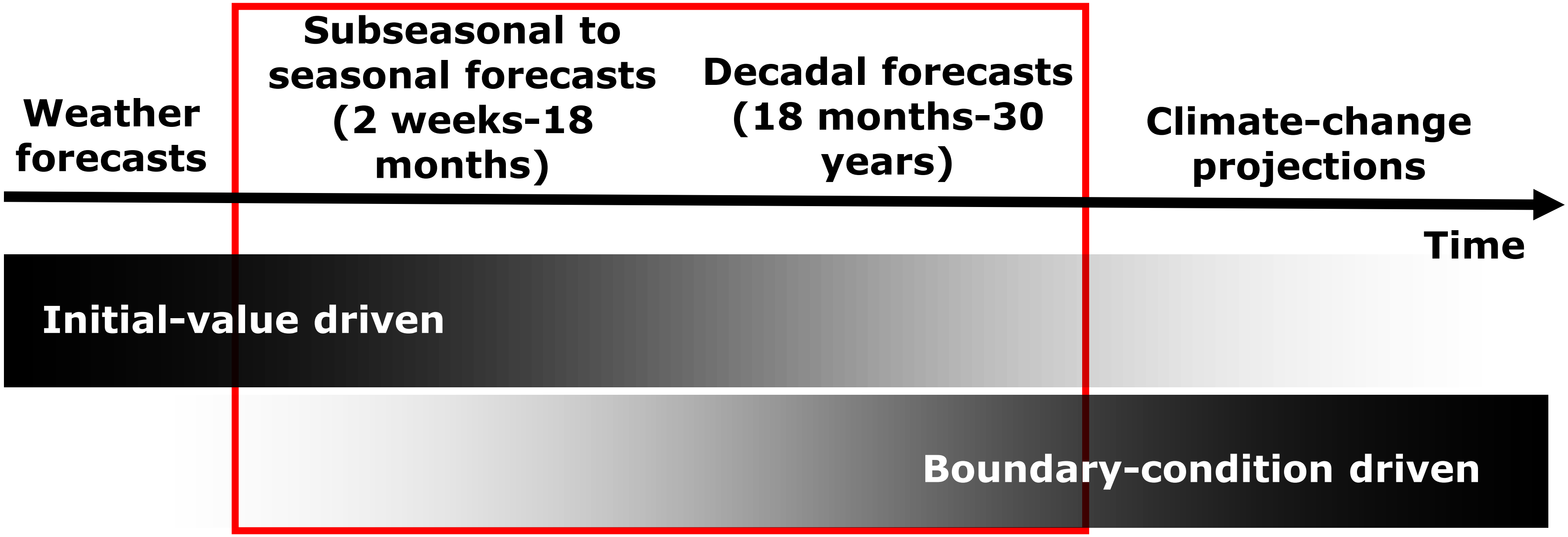
SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

Climate prediction

Progression from initial-value problems with weather forecasting at one end and multi-decadal to century projections as a forced boundary condition problem at the other, with climate prediction (sub-seasonal, seasonal and decadal) in the middle. Prediction involves initialization and systematic comparison with a simultaneous reference.



Adapted from Meehl et al. (2009)

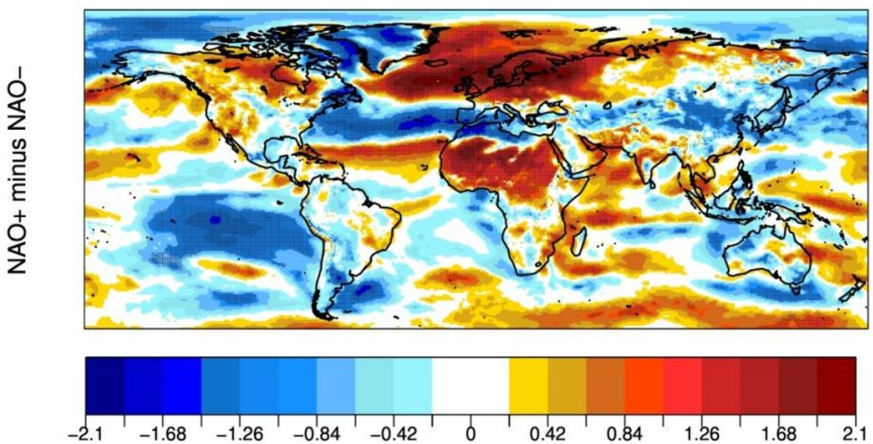
Frontiers in climate prediction

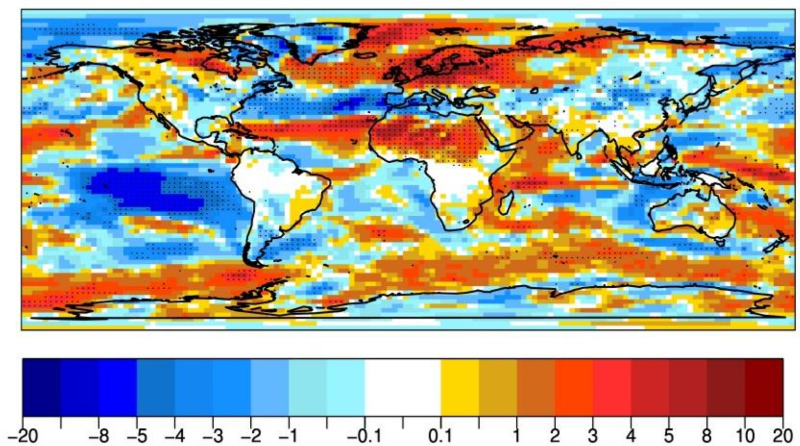
- Work on initialisation: initial conditions for all components (including better ocean), better ensemble generation, etc. Link to observational and reanalysis efforts.
- Model improvement: leverage knowledge and resources from modelling at other time scales, drift reduction, better sea ice, projections of volcanic and anthropogenic aerosols, vegetation and land, etc. More efficient codes and adequate computing resources.
- Calibration and combination: empirical prediction (better use of current benchmarks), local knowledge.
- Forecast quality assessment: scores closer to the user, reliability as a main target, process-based verification.
- More sensitivity to the users' needs: user-relevant downscaling, better documentation (e.g. use the IPCC language), demonstration of value and outreach.

Why caring?

Difference in winter (DJF) standardised 10-metre wind speed (left) and capacity factor (right) for seasons with above normal and below normal North Atlantic Oscillation index.

Daily capacity factor (%) calculated from ERAInterim 10-metre wind speed and temperature data using an idealised power curve, a log scaling law to transform the wind to hub height wind, and a Rayleigh distribution to model diurnal variability.





A. Pintó (IC3), D. Macleod (Univ. Oxford)

SPECS motivation

What: to produce quasi-operational and actionable local climate information

Why: need information with improved forecast quality, a focus on extreme climate events and enhanced communication and services for RCOFs, NHMSs and a wide range of public and private stakeholders

How: with a new generation of reliable European climate forecast systems, including initialised ESMs, efficient regionalisation tools and combination methods, and an enhanced dissemination and communication protocol

Where: over land, focus on Europe, Africa, South America

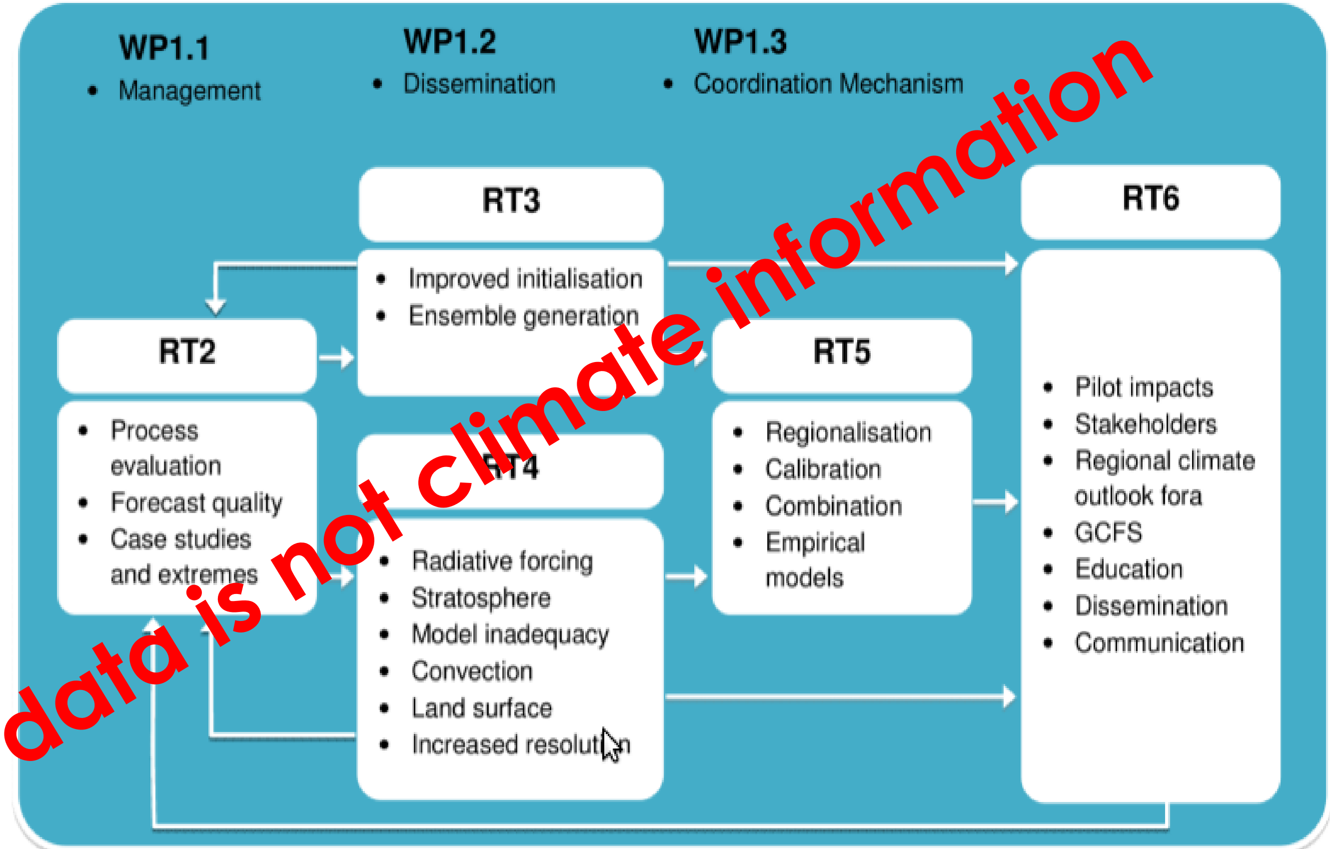
When: seasonal-to-decadal time scales over the longest possible observational period

http://www.specs-fp7.eu

SPECS: Overall strategy

Links to EUPORIAS/NACLIM, but also IS-ENES2, PREFACE, EUCLEIA, CLIPC, …

Forecast System	Project Partners
CNRM-CM5	CNRM, CERFACS
EC-Earth	KNMI, SMHI, IC3, ENEA
IFS/NEMO	ECMWF, UOXF
IPSL-CM5	CNRS
MPI-ESM	MPG, Uni[illegible]
UM	UKMET



WP1.1: Management
WP1.2: Dissemination
WP1.3: Coordination across EUPORIAS, NACLIM & SPECS
RT2: Evaluation of current s2d forecast systems
RT3: Forecast strategies
RT4: Improved systems
RT5: Calibrated predictions at the local scale

Climate data is not climate information

Coordinated experiments

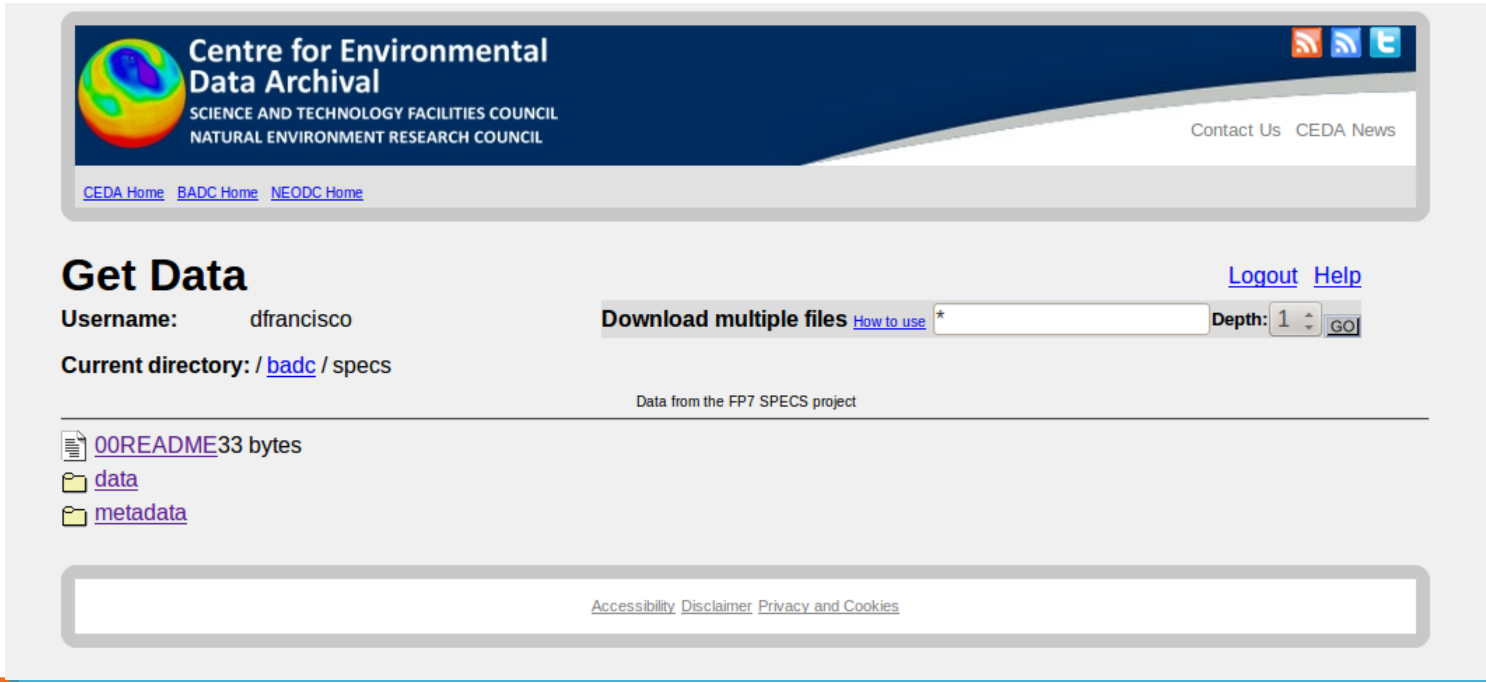
- Core (all forecast systems are expected to contribute to) and tier1.
- Not prescriptive, general purpose, linked to international activities (WGSIP, CMIP), definition to evolve during the lifetime of the project.
- Most experiments with two phases: development (quick to run and analyze) and production (redesign depending on development phase).
- Standard set up:
  - Seasonal: 10 members, May and November starts, 1981-2012, seven-month forecast length.
  - Decadal: 5 members, starts in 1960, 63, 65, 68, 70, 73, 75, 78, 80, 83, 85, 88, 90, 93, 95, 98, 2000, 03, 05, 08, 10, 13, five-year forecast length
- Focus on case studies and processes.
- Some of the experiments can be used, along with recent observations, for attribution studies.
- Common archiving and dissemination.

Data dissemination

Centralised data repository at BADC with files using a new convention building on both CMIP5 and CHFP, which will become the basis for CMIP6.

Data published on the ESG after quality control reachable by other SPECS-related services (ECOMS UDG, Climate Explorer, etc).

Multiple sensitivity experiments and NMME operational data already available.



Common tools for verification

GA 2014 verification demo

Aims and Agenda for the 2nd SPECS Verification Workshop [edit]

The aims of this short workshop are to:

- demonstrate new software that has been developed for verification;
- allow participants try this out on their own laptops;
- have a brief discussion about future needs and plans.

The planned agenda for the workshop is as follows:

Time	Activity
11:00-11:20	Demo of UNEXE SpecsVerification software
11:20-11:40	Demo of IC3 S2dverification software
11:40-12:00	Demo of Meteo-Swiss verification software
12:00-12:45	Hands on session for participants to try out software
12:45-13:00	Brief discussion about future needs and plans

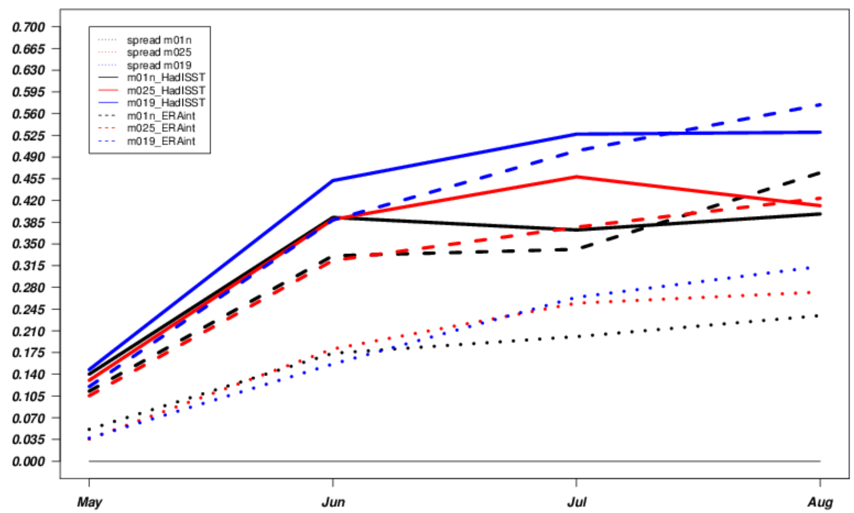
All these packages run in the freely available R language. See the R project site www.r-project.org to download R. Please also consider loading in your favourite forecast and observation data beforehand so that you can try out the verification on your own data.

More information about the new software is given below ...

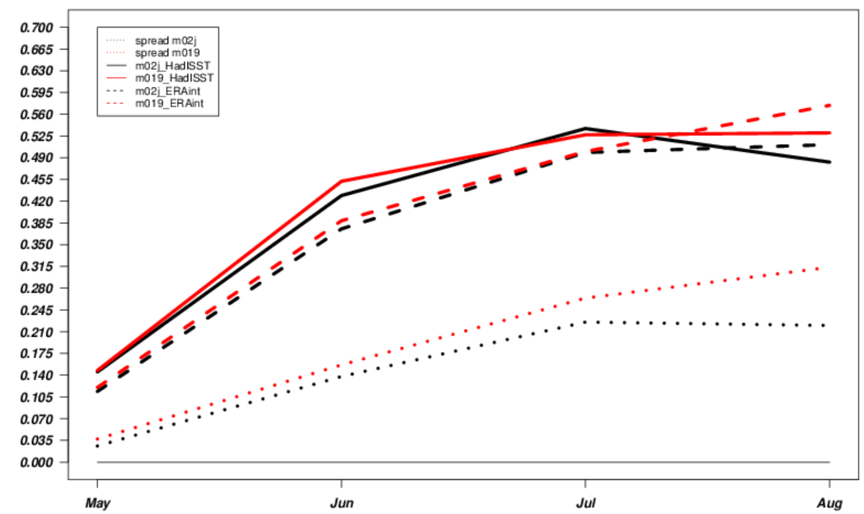
- SpecsVerification Demo talk-Media:Specsverification.pdf
- S2dverification Demo talk-Media:s2dverification.pdf
- Meteo-Swiss verification Demo talk-Media:veri.pdf

Impact of resolution

RMSE (solid and dashed) and spread (dotted) of Niño3.4 SST from four-month EC-Earth3 hindcasts: (left) T255/ORCA1, T511/ORCA025 and T255/ORCA025; (right) official release and modified rn_ebb. May start dates over 1993-2009 using ERA-Interim and GLORYS initial conditions.



Impact of resolution

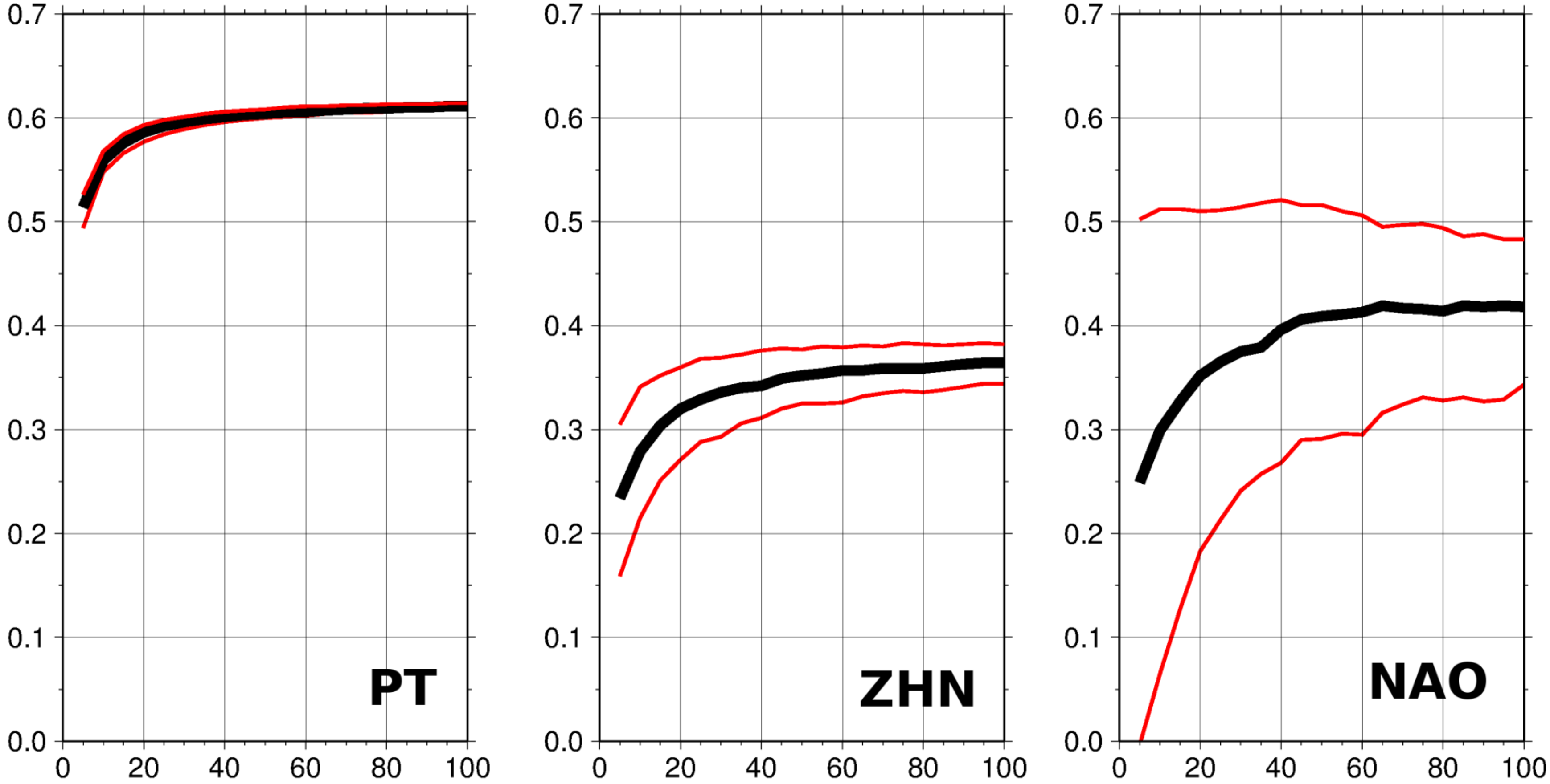


Change in rn_ebb

C. Prodhomme (IC3)

No shortcuts: ensemble size

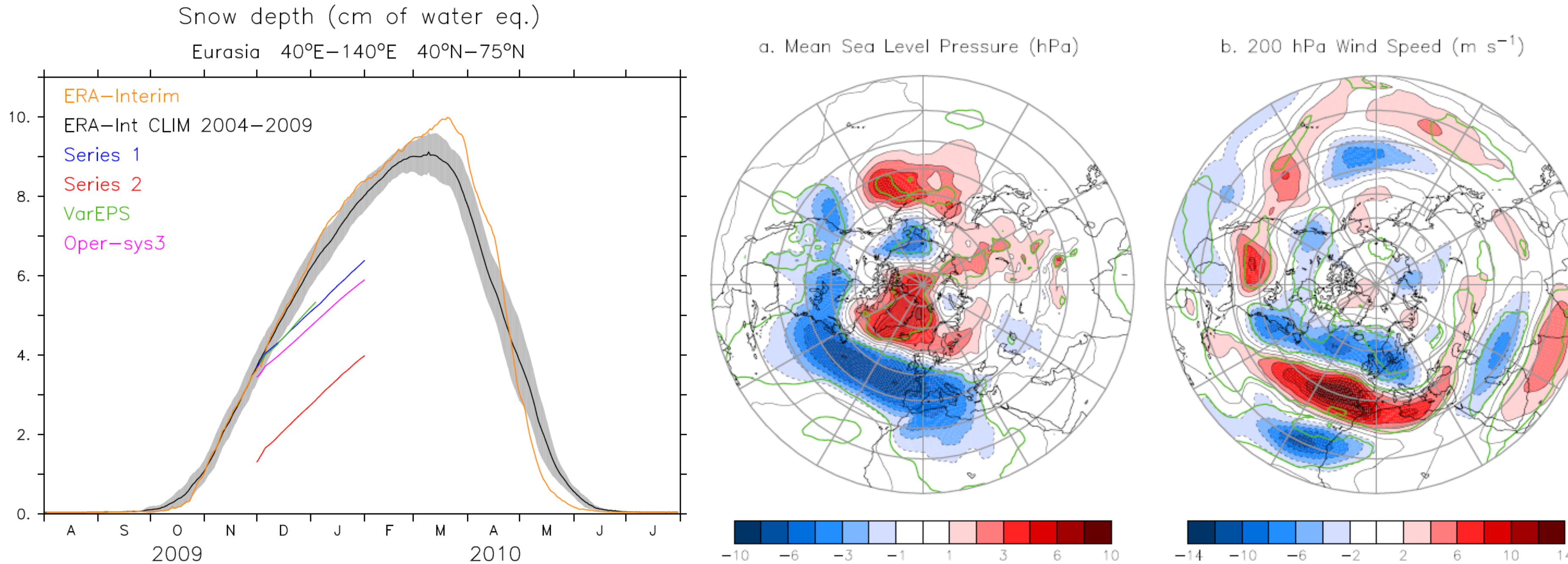
CNRM-CM's correlation for ensemble-mean predictions of DJF (one-month lead time) tropical precipitation, Northern Hemisphere Z500 and NAO as a function of the ensemble size. Red lines for 90% confidence interval.



M. Déqué (Météo-France)

Snow impact on predictions

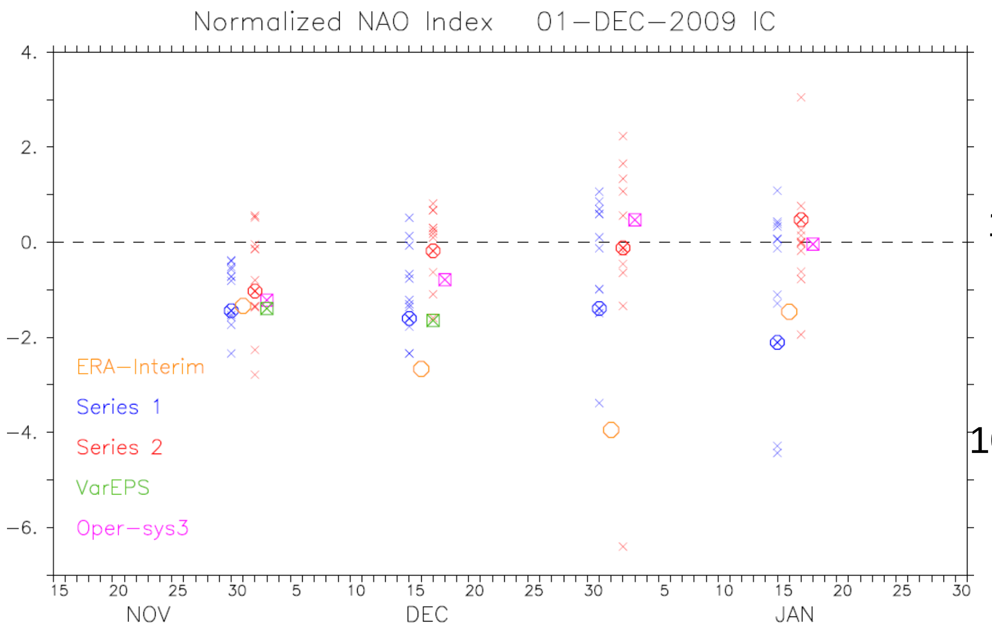
Snow-GLACE experiments with the ECMWF coupled system: 11-member ensemble initialised on the 1st of December 2009, Series 1 with land-surface initial conditions taken from ERALand and Series 2 taken from randomised states from previous years. **Do snow initial conditions really matter?**

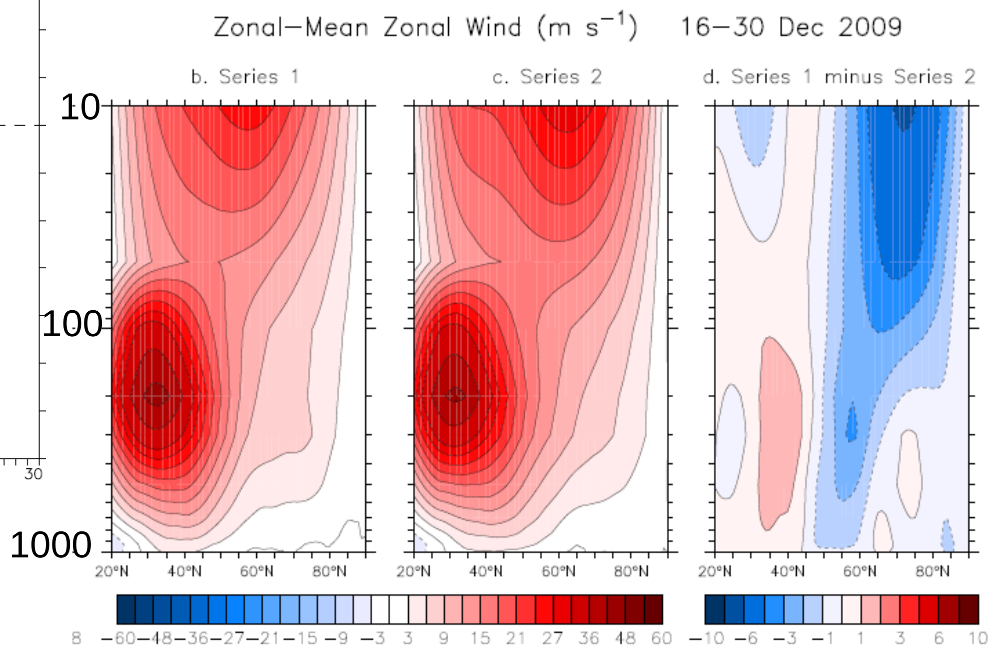


Orsolini et al.
(submitted to Clim Dyn)

Snow impact on predictions

Snow-GLACE experiments with the ECMWF coupled system: 11-member ensemble initialised on the 1st of December 2009, Series 1 with land-surface initial conditions taken from ERALand and Series 2 taken from randomised states from previous years. **The snow impact requires the stratosphere.**





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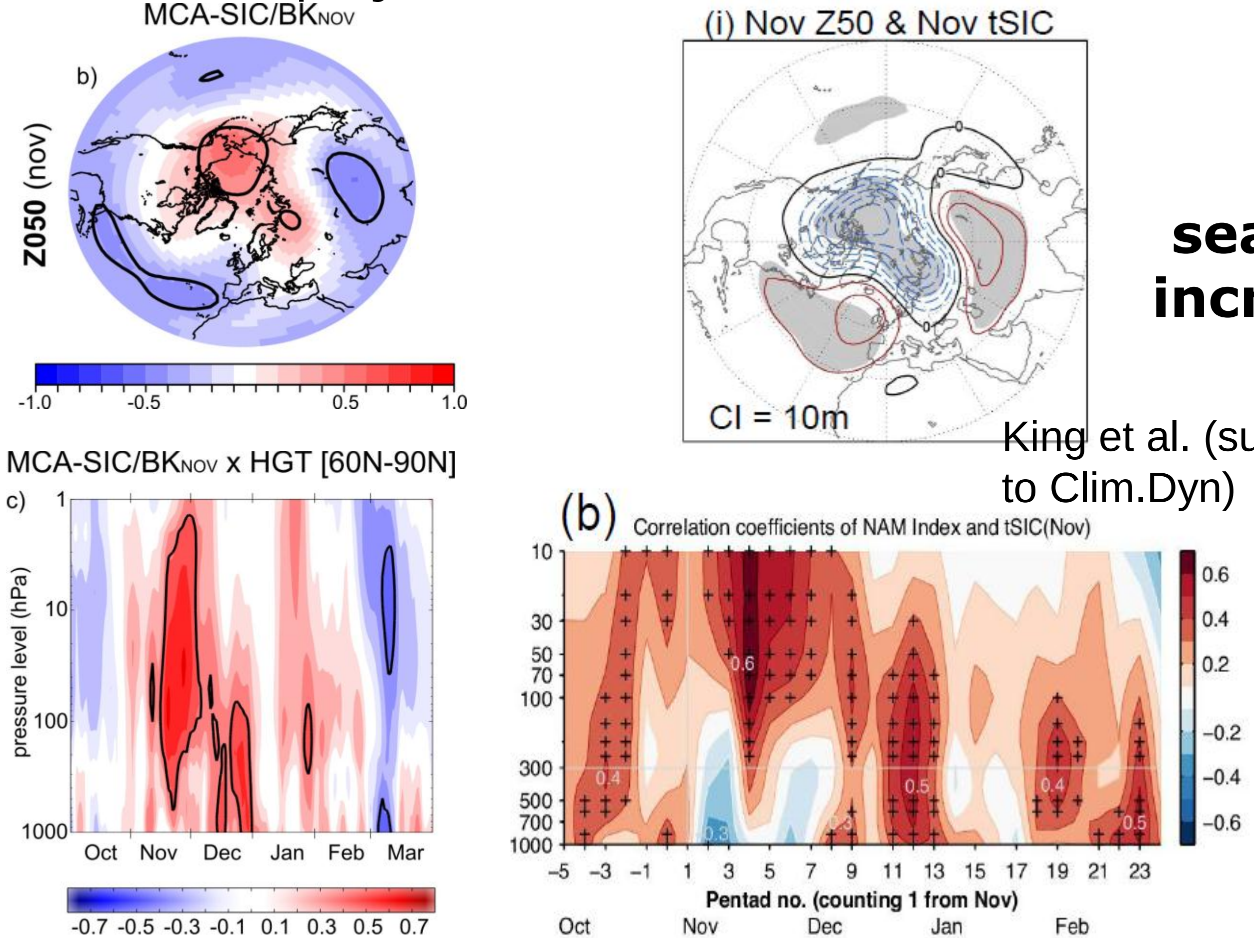
Sea-ice impact on predictions

November negative sea-ice concentration anomalies over Barents-Kara Seas -> weakening of the polar vortex (wave-2 structure) -> downward propagation of anomalies that project onto the NAO at surface in winter.

sea-ice decrease

sea-ice increase



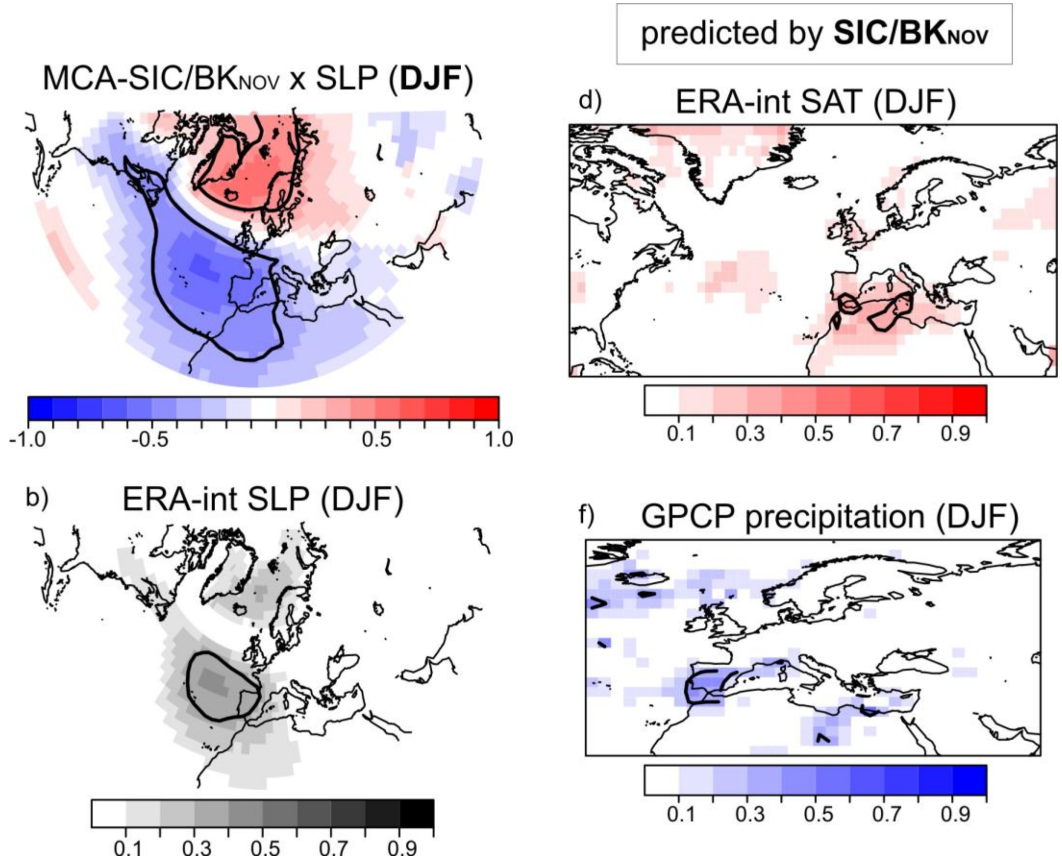
King et al. (submitted to Clim.Dyn)

García-Serrano et al. (submitted to J Clim)

Sea-ice impact on predictions

November negative sea-ice concentration anomalies over Barents-Kara Seas -> weakening of the polar vortex (wave-2 structure) -> downward propagation of anomalies that project onto the NAO at surface in winter -> **possibility to predict surface climate over Europe.**

sea-ice decrease



García-Serrano et al. (submitted to J Clim)

Eruptions and predictions

Major volcanic eruptions bring large amounts (Tg) of particles in the stratosphere

Last eruptions: Agung (1963), El Chichon (1982) and Pinatubo (1991)

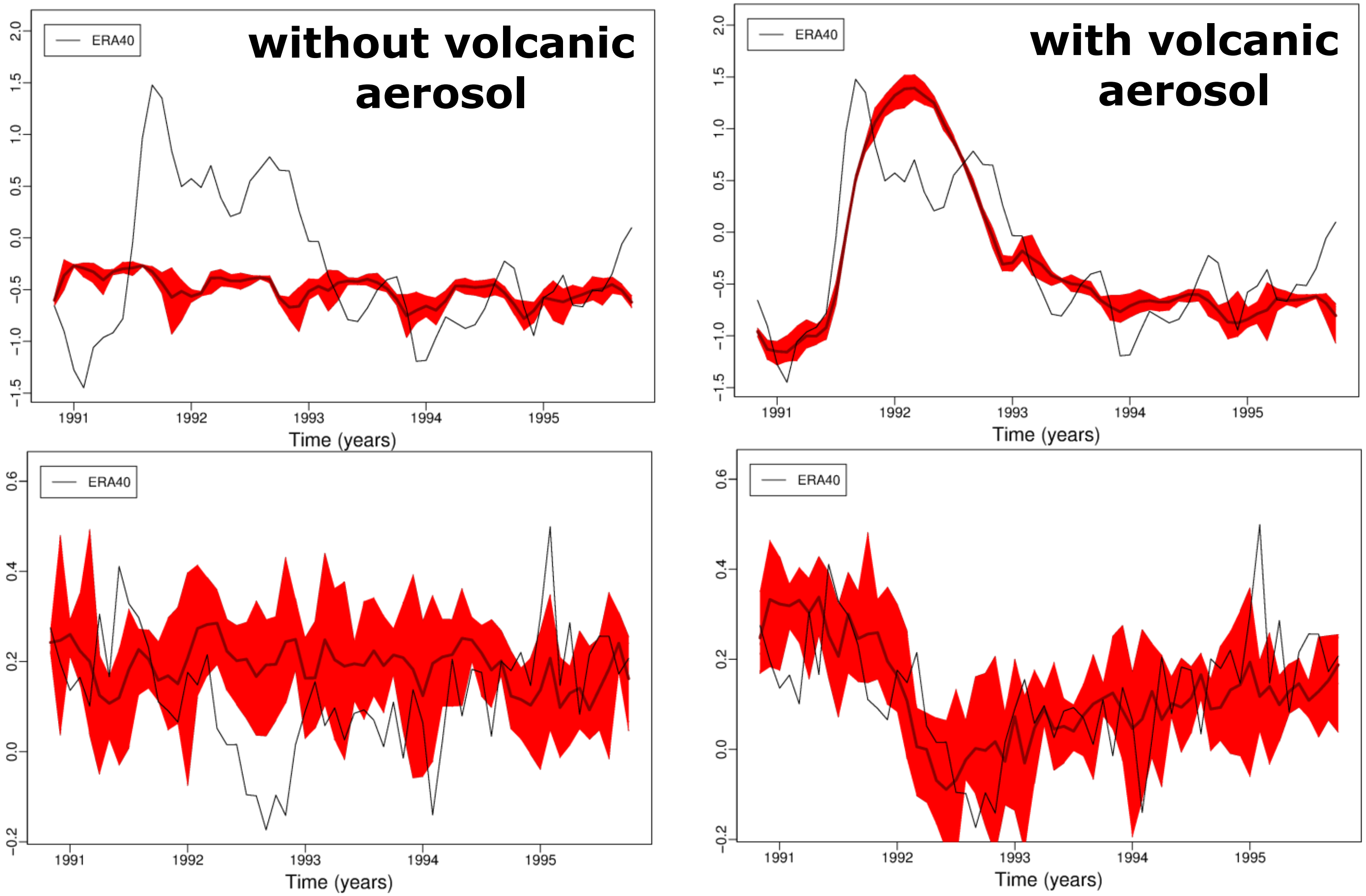
Serychev volcanic eruption June 1990 (NASA)

Eruptions and predictions

EC-Earth2.3 simulations of volcanic aerosol impact for Pinatubo. Five-member ensembles initialised on the 1 November 1990. **No consistent treatment of volcanic aerosol and ozone**.

T50

Near-surface air temperature

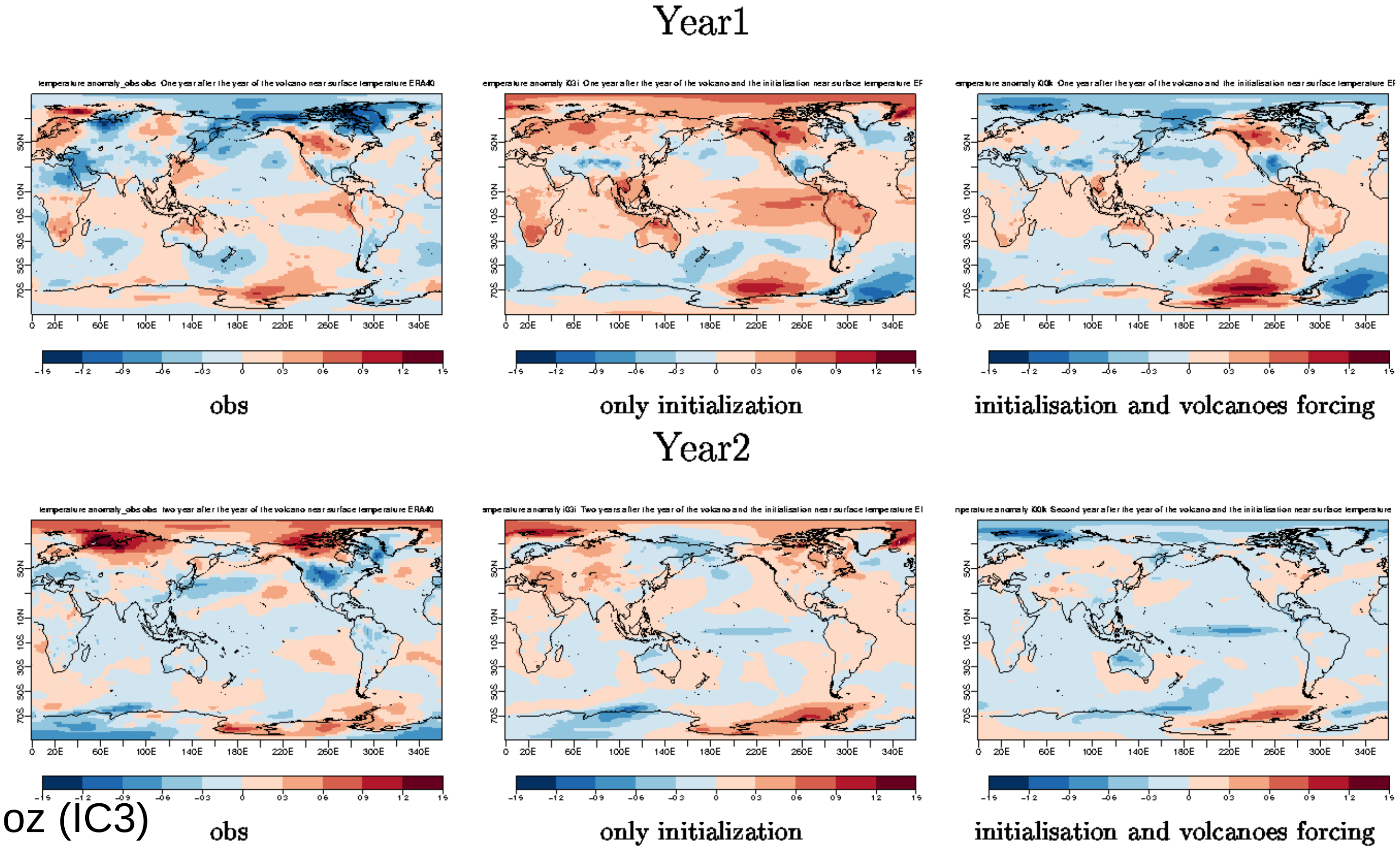


M.. Ménégoz (IC3)

Eruptions and predictions

Near-surface air temperature in the first and second forecast years of the EC-Earth2.3 simulations for the three main eruptions since 1960. The volcanic signal cools down the planet and produces a better forecast.

Five-member ensembles initialised on the 1 November before the eruption.



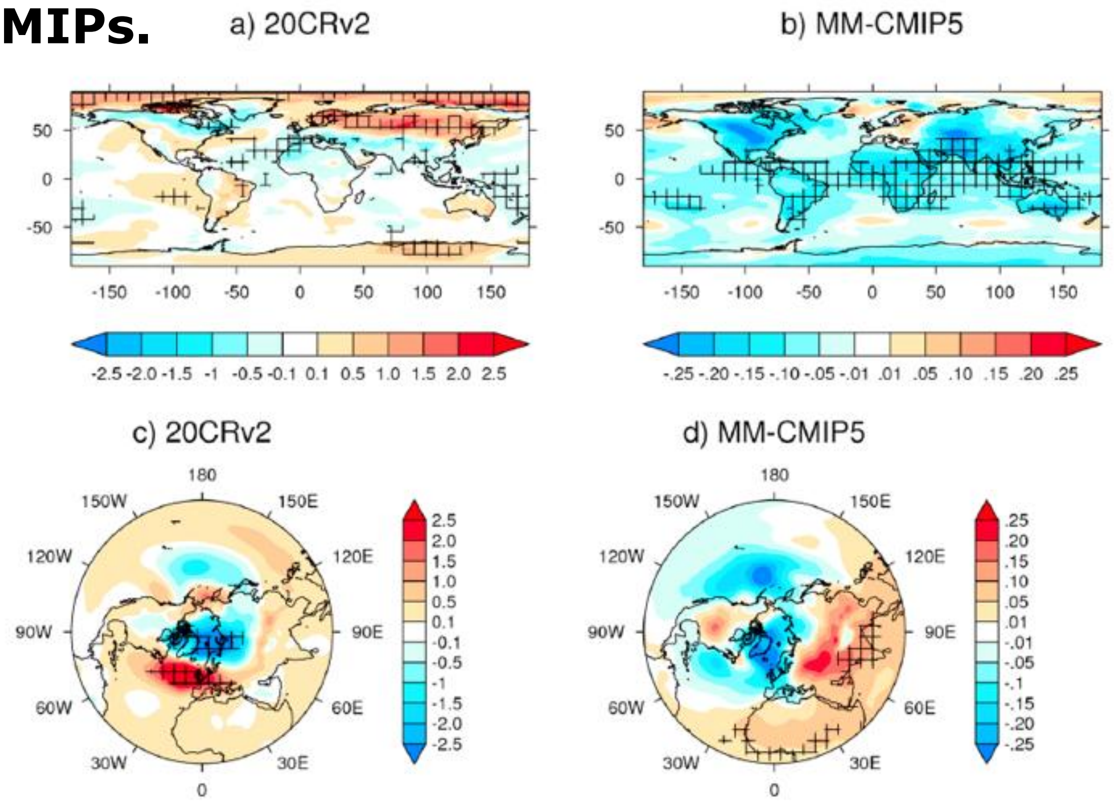
M.. Ménégoz (IC3)

Eruptions and predictions

Dynamical response: summer cooling and winter warming.

The winter warming could be explained by the warming of the tropical stratosphere that increases the meridional temperature gradient, intensifying the polar vortex and could lead to more frequent and intense NAO+ events. **CMIP5 models fail to do this -> Small sample -> Need connections to millennium MIPs.**

Surface temperature (top) and MSLP (bottom) anomalies averaged for two post-eruption winter over the XX Century.

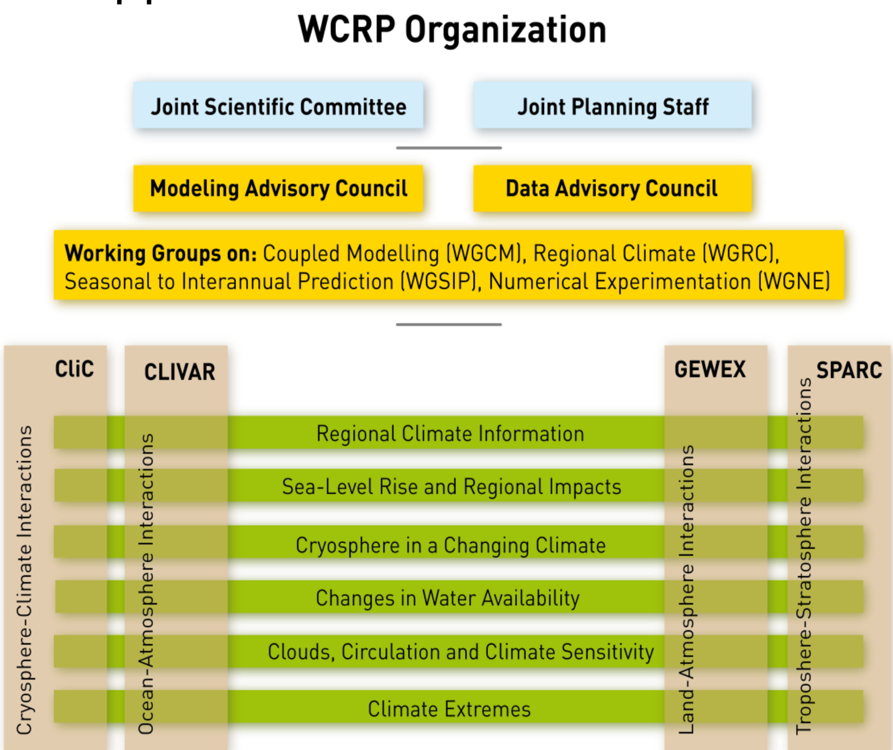


Driscoll et al. (2012)

WCRP RC Grand Challenge

Grand Challenge on Regional Climate Information: What gaps in our scientific understanding and information, if addressed, would maximise the value content of regional climate information?

Steering group: Clare Goodess (WGRC), Francisco Doblas-Reyes (WGSIP), Lisa Goddard (CLIVAR), Bruce Hewitson (WGRC), Jan Polcher (GEWEX & WGRC) and WCRP support.



Some messages

- Sub-seasonal to decadal forecasting (s2s) are becoming well established operational activities with a solid research base and an increasing application in climate services and adaptation. Decadal prediction is moving forward quickly.
- The demand of action-relevant climate information on s2d time scales is growing. However, what forecasters provide is far from users' demand (even in the absence of skill).
- Forecast system improvement is essential in the successful application of s2d climate information: how relevant is including atmospheric chemistry (short-lived species)? how is s2d variability (the hiatus) affecting stratospheric dynamics and chemistry?
- The connection between weather forecasting, climate prediction, atmospheric chemistry and climate change is still far from solved. The concept of environmental forecasting is just starting to be known and the climate-prediction community is trying to partner with other communities to address this issue -> CMIP6 is a unique opportunity.